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ABSTRACT

A study examined the views of principals, teachers, parents, and students pertaining to the role of vocational agriculture in developing and enhancing certain mathematical skills. During the study, researchers interviewed 36 secondary vocational agricultural teachers, 35 math teachers, 35 principals, 137 students, and 260 parents of students enrolled in 36 high school vocational agricultural programs throughout Iowa. All thirteen of the math concepts examined in the study were consistently regarded as being of greater-than-average importance to students studying in vocational agricultural programs. The math and vocational teachers' responses provided significantly higher mean scores than did the students' and parents' responses. Based on the responses of the study participants, recommendations were made calling for the following actions: inclusion of all 13 math concepts as part of the instructional program for vocational agriculture, with special emphasis on converting units of measure and on the use of whole numbers; recognition on the part of educators of the need to incorporate applied math concepts into the vocational agricultural course of study; and reliance upon mathematics teachers as a source of assistance for agricultural educators who are developing agricultural teaching materials and lesson plans incorporating applied math concepts. (MN)

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IMPORTANCE OF INCLUDING MATHEMATICAL CONCEPTS INSTRUCTION AS A PART OF THE VOCATIONAL AGRICULTURE PROGRAM OF STUDY

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Importance of Including Mathematical Concepts Instruction as a Part of the Vocational Agriculture Program of Study

Introduction

Agriculture is an industry that requires its employees to use and apply knowledge and skills from many disciplines if they are to be successful in their occupations. Therefore, agricultural education may need to be concerned not only with the body of knowledge that is unique to agriculture, but also other nonagricultural knowledge and skills which are applicable to agriculture. Agriculture relies heavily upon the language of mathemtaics for communicating its needs, describing its markets, and conducting its business. If employees need mathematical skills to function in today's agricultural industry, the following question must be answered. Should vocational agriculture assist its students in learning to apply mathematical skills and concepts?

According to Long (1972) teachers of mathematics have long been aware of, and attempted to meet the need for assisting their students in understanding the importance of mathematics in different areas of application. The teaching of mathematical skills in other courses and vocational tasks helps students to learn math concepts and realize that what they have learned is something more than isolated academic exercises. Henderson (1975), in discussing the future of instruction in mathematics, indicated that mathematics as a subject apart from other subjects may tend to disappear in favor of interdisciplinary approaches. Steen (1975) concluded that mathematics education is pluralistic and that there is a need for relating mathematics to its applications at all levels and areas of the curriculum.

Long (1972) identified 66 basic mathematical skills required for

success in related vocational education courses. He concluded that the skills most needed by vocational students included the four fundamental operations with whole numbers, basic use of fractions and decimals, rule reading, and rounding numbers.

A review of literature provides evidence that mathematics need to be stressed in all areas of the curriculum and that there are basic math skills needed by vocational students. The research question for this study was the following: What applied mathematical concepts should be included in Iowa vocational agriculture programs of study?

Purpose of the Study

The purpose of this study was to examine how principals, teachers, parents and students perceived the role of vocational agriculture in developing and enhancing selected mathematical concepts.

Methods and Procedures

Through a review of other studies involving mathematics and vocations, and related literature and textbooks, the following mathematical concepts were identified:

1. volume concepts
2. converting units of measure
3. use of whole numbers
4. ratio and proportion concepts
5. percentage concepts
6. metric units of measure
7. English units of measure
8. averages (simple statistics)

9. fractions
10. decimals
11. area concepts
12. simple algebra
13. graphs and tables

The basic math concepts identified were reviewed by college and high school math instructors. These items were then developed into an interview question format. The interview schedule and interview guidelines were field-tested for clarity and ease of understanding. After the field-test, revisions on both the interview schedule and interview guidelines were made.

A 99-point scale was used for respondents to record their perceived importance of including the application of each math concept as a part of the vocational agriculture curriculum. A scale value of "1" was used to indicate an item was of no importance; a scale value of "50" was used to indicate an item was of average importance; and a scale value of "99" was used to indicate an item was of utmost importance for inclusion in the vocational agriculture curriculum.

The research population for this study included Iowa secondary vocational agriculture teachers, teachers of mathematics, principals, vocational agriculture students, and the students' parents from 36 randomly selected schools in Iowa. One member from each of the three educator groups, one randomly selected student representing each grade level from 9 to 12, and the parents of the selected students constituted the sample for this study.

The interview schedule was administered at each of the 36 schools by group interview. Useable data were obtained from 36 (100%) of the vocational agriculture instructors, 35 (97.2%) of the math teachers,

35 (97.2%) of the principals, 137 (95.1%) of the students and 260 (90.3%) of the parents.

The data were tabulated and summarized. Means, standard deviations, one-way analyses of variance, and the Scheffé post hoc test were computed to compare the respondent groups' responses.

Findings

Mean importance ratings and standard deviations from the mathematical concepts are presented by respondent group in Table 1. F values from the analyses of variance tests are also provided which indicated if significant differences occurred among group means.

Insert Table 1 about here

Two mathematical concepts, converting units of measure and the use of whole numbers, were rated highest in importance with overall means of 75.7 and 75.2, respectively. Students and parents rated converting units of measure highest while vocational agriculture teachers and principals rated the use of whole numbers as most important. Math teachers gave application of area concepts their highest rating.

The math concept rated lowest in overall importance was teaching how to use simple algebra, with an overall mean score of 55.7. All five response groups gave this item their lowest rating.

Significant F values were found for seven of the thirteen concepts: 1) application of volume concepts, 2) ratio and proportion concepts, 3) use of fractions, 4) applications of percentage concepts, 5) application of area concepts, 6) use of decimals, and 7)

interpreting and using graphs and charts. The mathematics teachers rated each of the thirteen concepts higher than did the other four groups. The mean scores of the student group were lower than the other four groups for all math concepts except interpreting and using graphs and charts.

For math concepts in which significant F values were found, the Scheffé post hoc test was used to locate the significantly different group means. Ratings by the math teacher group for the application of volume concepts, use of ratio and proportion concepts and the use of fractions were significantly higher (.10 level of significance) than the ratings of the student group. The ratings of vocational agriculture teachers and the math teachers were significantly higher (.05 level of significance) than the ratings of the students and parents for application of percentage concepts. Math teachers' ratings of application of area concepts were significantly higher (.05 level of significance) than the ratings of the students and parents. Finally, both math teachers and principals rated interpreting and using graphs/charts significantly higher (.10 level of significance) than did vocational agriculture teachers, students, and parents.

Composite means were greater than 50 (average importance) for each of the five groups. The math teacher group produced the smallest standard deviation (13.3) and the parent group had the largest standard deviation (19.4) for the composite means. This finding indicated that the math teachers' responses were more homogeneous than the parents' responses.

The significant F value ($P < .01$) for the composite means indicated that the five groups did not rate the importance of the math concepts equally. The Scheffé post hoc test revealed that the math

teacher group composite mean (76.1) was significantly higher than the student group's composite mean (64.8) at the .05 level of significance.

Conclusions

The purpose of this investigation was to determine the role of vocational agriculture in developing and enhancing mathematical concepts as perceived by selected educators, parents and students. The results of this study provided a basis from which the following conclusions can be drawn:

1. All thirteen math concepts were consistently regarded to be of greater-than-average (scale value above 50) importance. This observation indicates that mathematics should be an important part of education in vocational agriculture.
2. The math teachers' responses produced the highest composite mean scores. This fact indicates that math teachers support the inclusion and application of math concepts in vocational agriculture programs of study even to a greater extent than the other four groups studied.
3. Students generally rated the importance of each math concept lower than the other groups. One explanation for this finding may have been that students expect the vocational agriculture program to stress agricultural subject matter and not mathematics.
4. The math teacher group composite mean was found to be significantly higher than the student composite mean. This result may be due to the fact that math teachers are very familiar with their subject matter and may be able to

perceive situations in which mathematics can be taught in agriculture whereas students may have a more limited view of the purpose of vocational agriculture instruction.

Implications

The following implications are based on the findings of this study:

1. All thirteen math concepts should be included as a part of instruction in vocational agriculture when they are applicable to problems in agriculture. Special emphasis should be placed on including instruction an converting units of measure and the use of whole numbers.
2. Educators should recognize the need to incorporate applied math concepts into the curricula and instructional materials used in vocational agriculture.
3. Mathematics teachers should be a source of assistance for agricultural educators in developing agricultural teaching materials and plans which incorporate applied math concepts.

References

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Table 1

Group Means and Standard Deviations for Importance of Including Mathematical Concepts in the Vocational Agriculture Program of Study by Participant Group

Concept	Vo Ag 36	Math 35	Prin. 35	Students 137	Parents 260	Total 503	F Value	P
Application of volume concepts	71.8[a] 21.1[b]	77.2 22.0	73.7 23.9	63.0 26.2	65.7 25.4	66.8 25.3	3.44**	.009
Convert units of measure	76.7 17.7	78.3 17.3	77.8 20.1	71.3 25.2	77.3 24.5	75.7 23.6	1.67	.155
Use of whole numbers	80.3 18.8	79.0 21.4	78.8 21.6	70.9 23.4	75.9 25.0	75.2 23.8	2.03	.089
Use of ratio and proportion concepts	71.4 21.7	76.1 21.3	74.7 22.4	62.5 25.8	65.9 26.8	66.7 25.8	3.33*	.010
Use of fractions	74.6 20.3	79.8 15.8	73.9 23.0	65.7 26.4	71.3 26.6	70.8 25.5	2.87*	.022
Application of percentage concepts	77.9 18.1	78.8 18.5	73.6 21.3	63.2 23.7	64.5 26.7	66.7 25.0	5.94**	.000
Use of English units of measure	66.6 26.1	69.1 25.6	65.1 27.0	66.2 26.8	68.2 28.8	67.4 27.7	0.22	.928
Application of area concepts	73.1 21.7	84.1 13.1	73.2 23.1	62.1 22.8	64.3 25.5	66.5 24.3	7.62**	.000
Use of decimals	76.1 20.5	82.3 14.1	71.3 23.9	65.8 26.3	69.0 27.8	69.7 26.2	3.49**	.008

Concept	Vo Ag 36	Math 35	Prin. 35	Students 137	Parents 260	Total 503	F Value	P
Use of averages	67.0 20.5	71.9 18.5	69.7 18.7	68.4 20.4	65.7 25.9	67.2 23.2	0.83	.508
Use of metric units of measure	72.4 19.2	73.5 18.2	70.7 20.5	63.7 27.8	70.3 29.4	68.9 27.2	1.84	.120
Use of simple algebra	60.1 23.8	60.4 22.9	58.9 29.3	52.7 30.9	55.5 30.6	55.7 29.7	0.87	.483
Interpreting and using graphs and charts	63.0 19.9	78.3 15.0	75.8 18.1	66.0 22.5	65.3 26.0	67.0 23.8	3.88**	.004
Composite	71.6 15.7	76.1 13.3	72.1 17.7	64.8 17.1	67.6 19.4	68.0 18.3	3.67**	.006

[a]Mean

[b]Standard deviation

*Significant at .05 level, (df=4,498)

**Significant at .01 level, (df=4,498)